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HILBRAND BOSCHMA

born 22 April 1893, well-known author on Rhizocephala and on corals, sketched in the other fields of his research and in his scientific functions

by

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For anyone who, now or in the future, in the far future, will have to do something with Rhizocephala, their systematics, microscopic anatomy, host specialization etc., it will be impossible to avoid the name and the work of Boschma. It rather seems that he can almost confine himself to this author.

Anyone who, now or in the future and in some respects a very far future, will have to do something with corals, Anthozoa as well as "Hydrocorallia", their systematics, ontogeny, normal and abnormal bud formation, their variability, their form in relation to the environment, their symbioses, their geography etc., will do injustice to himself and to science by not including Boschma's work in his studies.

For such colleagues this sketch of Boschma's life has been written, so that they may understand why and how Boschma's studies on these groups fit in his wider interest and skill in microscopic anatomy, in ontogeny, in certain aspects of physiology, in ecology and in zoogeography.

This sketch has also been written for many other biologists, who are interested in the scientific work and the social functions of an investigator known to them. They may learn from it how, from a comparative anatomist, working microscopically as well as macroscopically, from an ontogenist and from a naturalist, has grown a systematist who used his former interests as expedients. This sketch may also give an answer to the question as to what goes on in a museum of natural history, for it describes the character of such a museum, while at the same time it pictures the history of the Leiden museum in an important period. In a way it also contributes to establishing the fate of "natural history" within the limits of biology. On the one hand natural history intensifies its problems to those of systematics, which for its own purpose can use facts from nearly all other sub-sciences. On the other hand, natural history can thus develop into natural history in a new style, or into a special form of zoology.

Who is Hilbrand Boschma, on what fields did he write his publications and what are his social functions?

Course of life

Hilbrand Boschma was born at IJsbrechtum, municipality of Wymbritseradeel, in the province of Friesland. Boschma feels a Frisian and not first and foremost a Dutchman. There is some truth in his ever proclaimed statement that Dutch is a foreign language to him, like English. However, it must be said that he has a perfect command of both. His appointment in 1953 as committee member of the Biologysk Wurkforbân (Biological Study Group) of the Fryske Akademie (Frisian Academy) was in agreement with his feelings.

Boschma attended the secondary school at Sneek and, as was compulsory at the time for being allowed to take university examinations, took the supplementary examination in Latin and Greek.

For his university study in botany and zoology Boschma went to the Gemeente Universiteit (Municipal University) of Amsterdam, where among his tutors in these branches he could count the professors Hugo de Vries, Th. J. Stomps, Eugène Dubois, Max Weber, C. Ph. Sluiter and J. C. H. de Meyere. In a (published) address to freshmen biology students, held at Leiden in 1953, Boschma tells about the "candidaats" study, especially in the non-biological branches of their study (at the time mathematics, physics, chemistry and geology). He passed his "doctoraal" examination in 1919 and obtained his doctor's degree at the same university on 23 January 1920. His thesis dealt with comparative vertebrate anatomy, a subject which was much studied by zoologists at the Dutch universities in those years. The fact that during his subsequent scientific career he undertook the study of the systematics of an animal group collected by the "Siboga" Expedition, is another characteristic of Dutch zoology of those years. A third characteristic, which is also expressed in Boschma's scientific development, is his interest in field-observations on living animals in the "sphere of biology", by which is meant ontogenetic, functional-anatomical and ecological investigations. The task concerning the biological studies in the tropical Netherlands, i.e. the Dutch East Indies, was assigned to the young Dutch biologists of that time who appeared to be predestined for scientific research.

In October 1920, shortly after his graduation, Boschma left for the Netherlands East Indies for investigations discussed elsewhere in this paper; his work being supported by the Buitenzorg Fund. He did not leave the Indies until September 1922. In 1921 he was temporary head of the Treub Laboratory of 's Lands Plantentuin at Buitenzorg (Java). Following his stay in Java, Boschma joined the expedition of the Danish zoologist Dr. Th. Mortensen to the Kei Islands and the Banda Sea, which expedition he left in August 1922.

In October 1922 Boschma returned to the Netherlands, where (on 1 November 1922) he became principal assistant at the Department of Zoology of the Rijksuniversiteit at Leiden, with Prof. Dr. P. N. van Kampen as director. At the same university he became lecturer in comparative ontogeny of the Invertebrata in the autumn of 1923.

In 1924 Boschma obtained a scholarship from the Netherland America Foundation for a study visit to the U.S.A. There he devoted himself to the study of the food reactions and the food consumption of the coral *Astrangia danae* L. Agassiz and visited Woods Hole, Mass. In 1925 he made a journey as Fellow of the International Education Board and visited the institutions at Bermuda, the Tortugas, and La Jolla, California.

In December 1925 Boschma became in addition lecturer for the tuition in zoology to medical students.

On 1 July 1928 he was appointed reader in zoology at the Rijksuniversiteit at Leiden. In 1929, shortly after his appointment as a reader, he took part in the Snellius Expedition to the Netherlands East Indies. For this expedition, which explored the seas of the eastern part of the Malay Archipelago, Boschma was granted a leave of absence from 9 March 1929 till 9 September 1930 (the expedition lasted until November 1930).

In 1931 Boschma succeeded Prof. P. N. van Kampen as ordinary professor of Zoology at the Rijksuniversiteit at Leiden.

Following the death of Prof. E. D. van Oort, the director of the Rijksmuseum van Natuurlijke Historie at Leiden, Boschma was entrusted in the autumn of 1933 with the temporary management of this museum. This was the prelude to a highly important change in Boschma's task, to the benefit of Dutch as well as of international zoology. It caused Boschma in June 1934 to lay down the directorate of the Zoological Department of Leiden University and to accept the directorate of the Rijksmuseum van Natuurlijke Historie at Leiden. This also involved the change of his professorship in general zoology into that in systematic zoology at the same university.

In 1939 Boschma joined the expedition to the Wissel Lakes area of the central mountain range of Netherlands New Guinea, sent out by the Koninklijk Nederlandsch Aardrijkskundig Genootschap (Royal Dutch Society for Geography) and the Maatschappij tot Bevordering van het Natuurkundig Onderzoek in Nederlandsch Indië (Society for the Promotion of scientific Research in the Dutch East Indies). During the expedition Boschma was entrusted with the general zoological investigation of the area. In March 1940, shortly before the German invasion of the Netherlands, Boschma returned to Leiden.

In connection with measures taken by the German occupation forces,

Boschma as well as a number of his colleagues resigned from his office. He was dismissed on 1 February 1943 and at the same time he was appointed acting director of the Museum; after the war, on 5 May 1945, Boschma was again appointed director of the museum and ordinary professor.

Having reached the official retiring age, Boschma ceased to be director of the Rijksmuseum van Natuurlijke Historie on 1 May 1958. On 1 September 1963, the year in which he reached the age of 70, he was honourably retired from his office of professor at the University of Leiden. This was followed by a temporary appointment until the time that his successor could take over.

Boschma as a visitor of general congresses and meetings abroad

Since his first years as scientist Boschma was a regular visitor of general scientific and zoological congresses, chiefly international and western European.

As concerns the International Congresses of Zoology, we see him for the first time as a participant in the 10th congress in Budapest in 1927. He was absent from the 11th congress in Padua in 1930, but we find him again as a participant in the 12th congress in Lisbon in 1935, the 13th congress in Paris in 1948, the 14th congress in Copenhagen in 1953 and the 15th congress in London in 1958. It was for reasons of health that he cancelled his provisional registration for the 16th International Congress of Zoology in Washington, D.C.

He also regularly attended the meetings of the Pacific Science Congress. Following his participation in the Snellius Expedition, he visited the 4th Pacific Science Congress held at Batavia and Bandoeng in 1929. We also see him at the 5th Pacific Science Congress at Victoria, B.C., and Vancouver, B.C., Canada, in 1933. From the 6th congress Boschma was absent, but at the 7th Pacific Science Congress in New Zealand in 1949 we meet him as a delegate of the Dutch government and as head of the Dutch delegation, representing the Koninklijke Nederlandsche Akademie van Wetenschappen (Royal Netherlands Academy of Sciences). In this function he also visited the 8th congress, held in Quezon City near Manila in 1953. He was absent from the 9th congress at Bangkok, but participated in the 10th Pacific Science Congress at Honolulu, 1961.

At the meetings of the British Association for the Advancement of Science, Boschma is often seen. He visited the congresses at Norwich in 1935, at Cambridge in 1938, at Dundee in 1947, at Brighton in 1948, at Newcastle-upon-Tyne in 1949.

The congress of the Association française pour l'avancement des Sciences was attended by Boschma in 1947; it was held at Biarritz.

Boschma also attended the meetings of the Joint Commission of Oceanography, held in London in 1947 and at Newcastle-upon-Tyne in 1949. In 1948 he visited the congress of the International Union of Geodesy and Geophysics at Oslo.

In 1962 Boschma was present at the official opening of a new laboratory for marine biology at Hambaara near Trondheim, Norway.

This section on Boschma's visits to congresses abroad may be closed with a statement from a travel report, in which he gave his reasons for considering visits to congresses to be of importance, the main thoughts being: the personal contact with congress speakers and other colleagues during and after the discussion highly facilitates the exchange of ideas and data (concerning both scientific research and institutional interests, the latter being of great magnitude for any museum on an international level); the promotion of combined research on special problems, with the help of a "standing committee" whose report at the next congress leads to discussions and exchanges of ideas; certain resolutions and recommendations sometimes achieve success at a congress meeting; the excursions which are usually connected with the congress and during which institutions are visited and different types of landscapes are seen, can be profitable for the insight into the scientific development of a country and its biogeographical problems; finally, combining the participation in a congress with visits to colleagues and institutions on the way up or back, can be of great value for the exchange of thoughts and for acquiring new material.

Scientific significance of Boschma's publications on own research

In the first place we think of various studies about representatives of certain zoological groups, to which most of Boschma's numerous publications belong. They chiefly deal with a small number of groups, about which he has written many papers. For a number of years, and in some cases for many years, Boschma devoted himself with great persistence to some of these smaller groups. However, especially in his earlier years, he did not confine himself to systematic investigations. In his taxonomic studies he adopted a special arrangement of the subject-matter, dependant on the animal group under discussion. For this reason these publications cannot just always be brought under the heading "systematics", but they must sometimes be classed under "special zoology".

In the course of years, Boschma's main subjects of investigation have been:

1. Reptilia and Amphibia: comparative anatomy (based especially on embryology) and functional anatomy (1920-1925) (4 titles).

2. Corals from the group of the Anthozoa: at first feeding, symbiosis, bud formation, later also variability, and systematics (1922-1961) (33 titles).

3. Rhizocephala: systematics, microscopic anatomy, variability, hosts, zoogeography (1925-1963) (109 titles).

4. Cetacea (Mammalia): general shape, and structure, place, variability, and pathology of teeth (1937-1951) (9 titles).

5. Ellobiopsidae (Protozoa): systematics and microscopic structure (1948-1959) (4 titles).

6. Corals from the group of the "Hydrocorallia" (Milleporina and Stylasterina): systematics, variability, especially on account of environment (1948-1963) (40 titles).

Besides these six main categories, there are nine papers dealing with representatives of other large animal groups; they can be found in the appended list of publications.

The two main groups in Boschma's scientific work, viz., the corals (2, 6) and Rhizocephala (3), will not be discussed here.

1. Reptilia and Amphibia; comparative anatomy (based especially on embryology) and functional anatomy

In these fields Boschma wrote his first publications, which is understandable, considering the character of the zoological investigations pursued at Amsterdam University at the time.

His thesis of 1920 deals with the cervical skeleton of crocodiles. By means of microtome sections of four embryological stages of *Crocodylus porosus* Schneider, of one of *Caiman sclerops* (Schneider) and of one stage of *Tomistoma schlegelii* (S. Müller) (some stages being represented by more than one specimen), the topographic anatomy of details of these stages is described in relation to the elements of the cervical vertebral column: vertebrae, vertebral processes, processus odontoideus, separate pieces of cartilage at the top of the processus odontoideus, the dorsal end of the so-called proatlas, neural arches of the atlas etc., the absence of the intervertebral hypochordal arch or other formation between the processus odontoideus and the epistropheus, the first two cervical ribs, the ligamenta, muscle septa, blood vessels, etc. Besides the topographic anatomy, he studied the development and course of development of separately originating skeletal elements, of paired elements (also of the proatlas); the time of origin and fusion as well as the histological structure play a part. As a subsequent part of the in-

vestigation we find a comparison of the condition in embryos with that in recent and fossil adult crocodiles, with data from the literature. Another point of investigation is the phylogenetic cranial shifting of the two foremost ribs, which is, from an ontogenetic point of view, "kaum mehr nachweisbar".

Among the theorema added to this thesis we do not only find some in the field of comparative anatomy (homology etc.), but also on functional anatomy and ecology (symbiosis, parasitism, adaptation).

A second anatomical problem in embryology, investigated by Boschma in his first scientific years, is that of neuromery, i.e., the phenomenon of the segmental structure of the spinal cord; that is the actual neuromery, to be distinguished from an apparent segmentation caused by locally impeded growth. Basing himself on microscopical serial sections Boschma confirmed that the actual neuromery is a local widening of the central canal of the spinal cord at the places of the second phenomenon, which consists of a local segmental "Ausbuchtung" or "Verbreiterung" or swelling of the spinal cord, caused by a local accumulation of a larger number of nuclei in the grey substance, set off from the constrictions between them, while the white substance forms a layer of uniform thickness everywhere. This gives as a total result a slight constriction at the outer surface of each segment. These phenomena of the actual neuromery appear in a certain period of the ontogeny and disappear at a later stage. Boschma came to these conclusions by investigating embryos of *Hemidactylus frenatus* Duméril & Bibron, *Mabuia, Calotes, Lygosoma, Draco volans* L., *Iguana tuberculata* Laurenti, *Lacerta, Crocodylus porosus* Schneider, *Python bivittatus* Schlegel and *Cinosternum.* In all these examined Reptilia neuromery occurs in certain stages of the ontogeny. However, in examining the serial sections of some Amphibia, Aves and Mammalia, Boschma found no indications of neuromery in any developmental stage. According to Boschma the appearance of the actual neuromery is not caused by pressure of the surrounding tissue, but by an active process of the spinal cord itself, viz., the swelling of each neuromere by an accelerated increase of the number of nuclei.

A third problem deals with the funnel-shaped mouth of the larvae of the amphibian *Megalophrys montana* Kuhl, of which the functional anatomy and the biological function as part of the life history were studied. This investigation was carried out at Tjibodas during Boschma's first visit to Java. Numerous behavioural aspects of the animals resulting from a change of water and food were examined and described. Of the funnel-shaped mouth, which occurs in two different types, the shape, width and position is described. By means of simple experiments with strychnine the effect of the action of some smaller muscles on the shape of the funnel is determined. Likewise

with simple experiments with carmine powder a study is made of the action of the funnel in sifting of food and in taking in and ejecting small particles and small organisms in the surrounding water. In connection with this the intestinal contents were examined. According to Boschma, the incisions in the inner wall of the funnel do not have the character of warts to be used for crushing particles of food.

A fourth publication concerns a study of the colour changes of the skin of the lizard *Ptychozoon homalocephalum* (Creveldt), carried out by Boschma at Buitenzorg (Java) in 1921. To some extent the colour changes with that of the environment. With each specimen Boschma performed a series of experiments: in the first place he changed the colour of the environment and in the second place he covered the eyes of the lizard with a non-transparent cap. The experiments were made under otherwise constant conditions: light intensity, temperature, degree of humidity and structure of the substratum. As an objective measure of the colour, photographs were made on the same spot in diffuse daylight at the same distance from the window. Under these conditions the skin proved to assume a colour which highly simulates that of the environment. The distribution of the chromatophores in skins of different colour was investigated in microscopic sections. Boschma pointed out the useful effect of these colour changes in *Ptychozoon*, which sits on tree-branches both in bright sunlight and in very shady places.

4. Cetacea (Mammalia): general shape, and structure, place, variability and pathology of teeth

The fact that in February 1937 two young males of the sperm whale *Physeter macrocephalus* L. stranded in the estuary of the Westerschelde near Terneuzen, in the southern part of the Netherlands, not only induced Boschma to publish a popular note in 1938, but also to carry out a more thorough investigation. In an extensive paper of 1938 a detailed description was given of these two specimens, as well as a critical literature survey concerning the weight, the external measurements, the grooves on the throat, the dorsal fins or "humps", followed by some general remarks on parts of the skeleton. Moreover, this article contains a critical review of the specific name of this whale, and on various species of the genus distinguished by certain authors; a large number of figures in zoological books are discussed with special reference to the shape of the head, the position of the rostral point of the lower jaw, the teeth, etc., also of young specimens. The last chapter contains a large number of notes on the general distribution of the species and on its decrease in numbers in the later years. The middle part of the publication gives a very detailed description of the teeth of the two

mentioned Dutch specimens of *Physeter*. It describes the maxillary and the mandibular teeth of both specimens, their number on either side, their length (sometimes they are very short or even rudimentary), their breadth and other measurements, their shape (sometimes irregular, or curved), their form in cross section (either flattened or not); whether they extend beyond the gums or are embedded in the gums and whether or not they are functional (the so-called absence of these teeth in prepared museum-material as mentioned in the literature is explained by that the gums in which they were embedded have been removed together with the teeth); the more or less distinct alveoli; the exact topography of the teeth in each half of each jaw, with differences between left and right and upper and lower; the determination of the distance between the teeth. In the cases of functional teeth in both jaws, small polished facets are sometimes found in the place of contact. Teeth with surface fissures and a defective development of the lower part were classified as abnormal teeth. To this category may also be brought the teeth with more than one root and the teeth that actually are double; of these the transverse section is interesting. Among the pathological cases are those caused by caries and those caused by the development of osteodentine, first found as small isolated nodules in the pulp cavity, later covered by layers of dentine. These more or less irregular bodies of osteodentine can form outgrowths of the basal part of the tooth, and thus protrude from the base.

In another paper of 1938 Boschma described aberrant forms, found in an extensive material of sperm whale teeth, collected and preserved by whalers for their commercial value. Special attention is given by Boschma to the double teeth, which either originated by fusion of two teeth or by divergence of the roots. An examination of the exterior and of cross sections of the double teeth may give a solution of the cause. The fusion of the tops can find its origin in contact leading to a gradual union (this contact and the resulting pressure may cause the beginning of a disease leading to a deep cavity between the two teeth). A compound tooth may also find its cause in a close contact from the beginning, sometimes leading to a single undivided pulp cavity.

In a paper of 1950 on abnormal teeth in *Physeter macrocephalus* L. described in the literature, the absorption of the root of the tooth is said to be caused either by caries or by chronic inflammatory processes of the paradontal tissues a pathological process causing the loss of tissue. According to Boschma, too, the pressure from an adjacent tooth caused by a prolonged contact or friction of antagonistic teeth, was the primary cause of the inflammation which resulted in the pathological process of the absorption of

the root; as a reaction there can occur some regeneration with irregular outgrowths of tooth tissue and small exostoses of tooth material around the area of inflammation.

The maxillary teeth in *Hyperoodon rostratus* (Müller) or *Hyperoodon ampullatus* (Foerst.), stranded on the Frisian coast in 1946, and in *Mesoplodon grayi* Von Haast, stranded near Kijkduin on the coast of the province of Zuid Holland in 1927, are described accurately, their topography being exactly defined (1950, 1951), while the data in the literature are subjected to a critical discussion. These minute teeth found in *Hyperoodon* are undoubtedly entirely functionless and part of them can be easily moved about in their alveoli. The teeth in *Mesoplodon grayi* are not rudimentary; the rows of teeth prove that the Dutch specimen belongs to *Mesoplodon grayi* from the southern tropical waters and not to *Mesoplodon bidens* (Sowerby), the more common form from northern waters.

The rows of small teeth in ziphioid whales (as in *Tasmacetus, Mesoplodon, Hyperoodon* and *Ziphius*) are the special subject of another paper published in 1951. Sometimes one pair of front teeth of fairly large size are present in the lower jaw, and in old males may protrude above the gums. Rows of teeth have been subject to pronounced reduction; in *Tasmacetus* they show a fairly large size and are functional; in *Mesoplodon, Hyperoodon* and *Ziphius* they are much smaller and rudimentary. These small teeth occur in both jaws; they are often completely hidden in the gums, though still functional in some cases; sometimes their tips protrude from the gums. In this paper their number, topography, size, measurements, form (also in cross section), whether or not they protrude from the gums with their tips, and whether or not they are functional, are discussed. The presence of horny tubercles, of very hard but not calcified vestiges of rudimentary teeth is described, as well as that of empty or additional follicles. The possibility of a relation of the number of teeth to age is discussed. No cases of open pulp cavities were found; the roots were invariably closed by a bulbous mass of cement which often formed a root-like extension beyond the original basis of the tooth.

In a lecture which appeared in print in 1951, Boschma summarized many data and his views about Odontoceti, especially *Physeter, Kogia, Hyperoodon* and *Mesoplodon*. This article deals with the distinction between these genera and between the species within each genus. It discusses the size and shape of the body, the shape of the head, the colour of the external surface, the number of teeth in both jaws, on either side and in different specimens, the question whether or not the teeth are rudimentary, and the length of the lower jaw; the differences in colour etc., which are due to age and sex, are

commented upon. All these facts are discussed on the basis of the descriptions and illustrations given in literature as well as on personal investigations. The latter is especially the case with the shape of the teeth and the gradual change occurring in their shape from the anteriormost to the posterior teeth. These recent investigations also comprised the pulp cavity, the growth of the teeth and the filling of this pulp cavity with osteodentine. Moreover the article contains information about the alveoli, the rudimentary condition of the teeth, the wear on teeth, etc.

5. Ellobiopsidae (Protozoa): systematics and microscopic structure

The study of the material of the genus *Amallocystis* collected by the "Discovery" Expedition was the source of a detailed report (1949), preceded by a preliminary communication (1948).

This preliminary note deals with a then undescribed species *Amallocystis fagei,* a parasite of the Crustacean genus *Euphausia,* namely in the genital gland, which is reached after piercing the carapace. The essential organs are the organella for the absorption of food, showing protoplasmatic excrescences, piercing the sieve plate of the peripheral pellicula and running into the region of the genital gland. This is a second function of this organ for fixation of the ramified parasite with its clear development of trophomeres and gonomeres.

The publication of 1949 contains the description of all three larger species of the family Ellobiopsidae, all belonging to the genus *Amallocystis* (*A. fagei* Boschma, *A. umbellatus* Boschma and *A. capillosus* Fage). A comparison of the organ of fixation and the parts serving for the absorption of food was possible. Boschma's own investigations and the critical review of the literature give much information on the hosts (Crustacea, Polychaeta), and on the exact places on the host's body where the parasite is attached (rostrum, appendages of the head, gills, abdomen, abdominal appendages). It also gives much information on the sieve plate through which the protoplasmatic excrescences (the roots) protrude, on the differences in structure of the sieve plate in older and in younger specimens, on the protoplasmatic excrescences forming the root system protruding into a specific soft organ of the host. Furthermore, the publication supplies data about the external part of the parasite and its general form, consisting of one or a few bundles of cylindrical bodies, on one or on a number of stalks, each showing a number of branches, while as a rule each branch is divided into parts by distinct transverse grooves; the number and shape of the distal gonomeres, attached to the top of each proximal trophomere; the number varies in the different species; many measurements are given, as well as the shapes of the tropho-

meres and the gonomeres. Some cytological details of the trophomeres and the gonomeres are stated, especially the number of nuclei. The differences in the number of trophomeres and gonomeres in the various specimens depend upon the difference in host; in general there is a strong variation in the number of trophomeres and in the dimensions of trophomeres and gonomeres. Remarks are made on the sex of the host and the changes undergone by this parasitization, such as parasitic castration. For each species of parasite the known hosts are mentioned, as well as the number of separate individuals of the parasite on one host specimen.

The species of *Amallocystis* can easily be distinguished by the number and the shape of the stalks extending from the external part of the organ of fixation, whether or not in tufts or more or less separately originating, by the number of gonomeres on each trophomere, by the shape of the trophomeres and gonomeres.

At the end of the report, the genera of the family Ellobiopsidae and their differences are mentioned. It describes the divergent opinions about the systematic place of this family within the Protozoa. Many notes on the geographical distribution of the Ellobiopsidae are added.

Scientific merits of publications on general and economic zoology

In general zoology, data are arranged according to aspects independent of systematic groups.

As concerns Boschma's work, we think of publications about the following sub-sciences of general zoology:

1. Publications on systematics as such and on nomenclature (1931-1960) (9 titles).
2. Publications on zoogeography and the faunistics of certain countries (1927-1954) (3 titles).
3. A publication on ecology (1929) (1 title).
4. A publication on the economic aspect of animals (economic value and importance of some faunistic elements) (1937) (1 title).

1. Publications on systematics and nomenclature

For his inaugural address as professor of zoology, which took place prior to his appointment as professor of systematic zoology, Boschma's subject was "Het soortsbegrip" (the species concept). The conclusion to which Boschma comes is that one will also have to acknowledge as species that

group of organisms which do not distinguish themselves in structure, whose morphological features do not even show minimal, constant differences with other species, but which do differ from these other species in other (physiological, genetical) features. In Boschma's opinion, the view accepted until then, namely that there must be at least minimal constant morphological differences between species or strains, will have to be abandoned. Boschma draws this conclusion after a discourse on differences and resemblances between and within species. In this discourse facts from a great number of sub-sciences are reviewed, referring to shape (also in stages of development), to origin (also experimental origin of shape), to function, to ecological adaptations (to season, water, soil etc.), to biogeographical differences from a morphological and/or genetical and/or physiological point of view, to biochemical differences etc. Hereby these features are of special interest in intermediate and transitional forms. This is contrary to practical systematics, which proceeds on morphological principles and is based on a morphological description and on type specimens; these latter make it possible to check the characters mentioned in the diagnosis and those which later prove to be important.

About the importance of systematics as a sub-science of biology among the other sub-sciences, Boschma expressed his views in a publication of 1938, based on the number of abstracts in some volumes in Biological Abstracts. It appeared that the number of abstracts on systematic zoology was 23.18% of the total number of all abstracts in the field of biology s.l. Calculated in a similar way, the numbers of abstracts within systematic biology, expressed in percentages, were: systematic botany 20.1%, Invertebrata exclusive of entomology 24.5%, Insecta 31.2%, Vertebrata 23.8% and general systematic zoology 0.4%.

For the convenience of the numerous Dutch entomologists, in particular the amateurs, Boschma wrote (in the years 1946-1948) some articles regarding the International Rules of Zoological Nomenclature and the offences against them. For the benefit of the readers the articles are in Dutch, but they cannot be classed as "popular articles" for a general public, which usually appear in the language of the country. For a more general circle of biologists Boschma gave a survey, in 1948, of the important results of the activities of the International Commission on Zoological Nomenclature, which results were obtained during the International Congress of Zoology in Paris.

Another article of 1946 is of a different character and outlines the vicissitudes of systematic-zoological research in the Dutch East Indies in comparison to the surrounding countries as the then British India, Indochina, Siam, the Malay Peninsula, the Philippines, Australia, and in a few places

in the text also in comparison to Formosa and the Palau Islands. In this paper Boschma confines himself to five classes of Vertebrata, and to Mollusca and Insecta. He mentions the authors, the group studied, he characterizes and criticizes the work and defines its value for the present time. Boschma adds some observations on the historical growth of our knowledge (investigators, expeditions, cabinets, museums) and gives his opinion about the importance of a better knowledge in the field of systematics, also of the subspecies, for systematic science itself, for zoogeography and for historical geology. Boschma ends by expounding what demands should be made on publications about further inventories of the fauna.

2. Publications on the zoogeography and the faunistics of certain countries

The serial publication "Fauna van Nederland", edited by Boschma, was preceded by an introduction containing a historical survey of the increase of our knowledge of the fauna of The Netherlands, as well as a division of the territory into twenty districts which are mainly characterized by the different kinds of soil or demarcated by rivers. A review is given of published books, articles and lists of the fauna in general or on certain systematic groups, in relation to The Netherlands as a whole, or to certain provinces, islands or waters.

In 1947 Boschma published an article on the fauna of the Dutch territories in America, which gives separate surveys of the fauna of Suriname with its continental character; of the fauna of the islands of Curaçao, Aruba and Bonaire, which has some relationship to that of the continent of South America; and finally of the little known fauna of the islands of Saba, Sint Eustatius and Sint Maarten, which partly shows a North American character.

On the fauna of New Guinea an article by Boschma appeared in 1954; it treats of the mammals, birds, reptiles, amphibia, fishes, insects, arachnoids, crustaceans, molluscs and worms. The widely distributed sea-animals which are not characteristic of New Guinea, have almost entirely been excluded from consideration. The zoogeographical relations of the fauna of New Guinea to the Australian fauna and the relations of the numerous elements of western origin are indicated, as well as the geographical distribution of species, genera etc. within New Guinea. The same is done with the distribution of these species etc., if any, in other parts of the world. The relation of the zoogeographical distribution to the connections between territories in (pre-)history are referred to, while in some cases the ecological reasons for a certain distribution are indicated (e.g., fresh water inhabitants and marine species).

3. A publication on ecology

In a general zoology text-book for biology students at Dutch universities published in 1929, an article on "Ecology" appeared, written by Boschma. In discussing this, it should be borne in mind that another chapter by another author deals with symbiosis, synoecy and parasitism.

Boschma defines ecology as the physiology of whole organisms in relation to their surroundings, comprising the reactions of organisms to the outside world and the change of reactions of organisms in connection with changes in surroundings. A division of these questions as to their contents, or a division of ecology into autoecology (in the sense of reactions of the individual) and synoecology (in the sense of behaviour of associations of animals) has not been made. For that matter, Boschma states that there is no distinct line between ecology and other parts of zoology, such as physiology (especially physiology of the senses) and zoogeography.

In accordance with this, the fundamental notions of ecology are mentioned and defined in this article, but the emphasis is laid on the examples, of which a great many from several groups are mentioned and of which a number are discussed in detail. In this way the notions maximum, minimum and optimum are dealt with, furthermore the various abiotic and biotic factors, while the steno- and eury-phenomena are exemplified in connection with ecological valence. In this way are also treated the biosphere with biocenosis, its division into smaller units, such as the biotope with its biocenosis, the niche, etc. In a similar way the disturbance of the biological equilibrium is discussed, its fluctuations in the number of individuals, and its cessation. In addition, the different forms of mimicry and related phenomena are considered. In this way are treated the phenomena of the changes in associations of animals, caused by changes in plant associations with their phenomena of sere and climax. The discussion of food chains leads to that of staple-food, niches, pyramid of numbers, etc. The distribution leads to a discussion of the stages of shifting (rhythmical changes etc.), settling and maintenance. In conclusion a detailed survey is given about the three large areas of the biosphere and of the sub-areas in each of them: the five sub-areas of the sea, the numerous small sub-areas of fresh water (eutrophic, oligotrophic, running, stagnant, large, small, etc.), the many areas of the land (soil, vegetation, vegetation layers, open field, flat land, mountains with belts and animals living in the ground), etc. In the fauna of these areas and sub-areas are included the names of the ecological group, also of smaller biocenosis, the characteristics of these animals with morphological and physiological adaptation, etc.

4. A publication on the economic aspect of animals (economic value and importance of some faunistic elements)

The Dutch interest in the vicissitudes, the development of and the knowledge about New Guinea led Boschma to write in a handbook an article on a number of New Guinea animals which are of economic value and importance in other countries and continents. Boschma collected data about the export trade, the marketing areas and prices, but also about the species, their occurrence, and the way of catching and collecting them; the latter chiefly concerns pearls, mother of pearl, shells for buttons, tortoises, shark fins, sardines and a few other fishes, holothurians, birds of paradise, crowned pigeons, etc.

Boschma's lectures and addresses on his investigations

It seems hardly adequate to me to discuss here the lectures delivered by Boschma in The Netherlands. At the meetings of the Koninklijke Nederlandsche Akademie van Wetenschappen he has regularly met his "obligations" since his appointment, as early as 1946, and his scientific communications there appeared in print in the Verslagen and the Proceedings.

Incidentally he read a paper on zoological subjects for the Nederlandsche Dierkundige Vereeniging.

The stranding of two sperm whales gave occasion to profusely illustrated lectures for some societies and institutions in The Netherlands (Groningen, Rotterdam, 's-Gravenhage).

It may suffice here to mention a few lectures abroad, apart from those at the large congresses.

The variability of coral species was Boschma's subject for papers read in 1949 for the Fiji Society, for the University of Hawaii and for Scripps Institution of Oceanography.

In Paris, in 1950, Boschma delivered a lecture entitled "Remarques sur les Cétacés à dents et en particulier sur le Cachalot".

Merits in promoting and guiding zoological research and publication of the results

Also in this third field Boschma has been of great significance and merits for his own investigations and for those of many others. In this connection we want to consider:

1. Expeditions, collecting trips, visits to congresses and scientific institutions.
2. The Rijksmuseum van Natuurlijke Historie at Leiden.
3. Editorship of zoological journals.
4. Editorship of the series "Fauna van Nederland".

5. Chairmanships and memberships of working committees on matters relating to nomenclature.
6. Text-book articles.
7. Tuition and education.

1. Expeditions, collecting trips, visits to congresses and scientific institutions

In this section we will not go into Boschma's exertions for the participation in expeditions and collecting trips made by others: some of this can be found under a following heading dealing with the Rijksmuseum van Natuurlijke Historie. We only wish to mention here the expeditions and the collecting trips in which Boschma himself took part. If to this we add the journeys made by Boschma for obtaining and examining material, this brief report cannot but be most incomplete, because on each journey and on each visit Boschma sought an opportunity to collect and study material for his own investigations as well as those of others. Sometimes these trips were made in the open field, sometimes to museums, where he examined Rhizocephala and certain corals: these products of nature in these buildings of culture were mainly the aim of Boschma's "sight-seeing".

Two expeditions which Boschma joined should be mentioned here: the Dutch oceanographic expedition on board the "Willebrord Snellius" in the eastern part of the Dutch East Indian Archipelago, and the expedition to the Wissel Lakes in New Guinea.

The expedition-staff on board H.M.S. "Willebrord Snellius" undertook the voyage from Holland and make a fifteen months' cruise; the voyage lasted from March 1929 till November 1930 (Boschma left the expedition in August 1930). The aim of this cruise was to collect data and material in those areas which had not or insufficiently been explored during the "Siboga" Expedition. Consequently, biology — Boschma was the "biologist" on board the expedition-ship — played a minor part and was restricted to some points that were also of interest to the geologist. These points were: 1) collecting plankton, at stations (surface plankton, deep-sea plankton, occasionally macro-plankton and nanno-plankton); application of methods to obtain an insight in the horizontal and vertical distribution of plankton organisms; 2) the study of the coral reefs by a local investigation into the distribution of the species and into the variability of the colonies themselves; 3) collecting bottom animals by dredging; but this only took in a minor part of the programme.

The second expedition in which Boschma took part as a zoologist, was that to the Wissel Lakes in New Guinea, from August till November 1939 and during which he was assisted by four mantris (Javanese preparators).

Collections were made near the landing- and departure-basis on Etna Bay, at Enarotali on Paniai Lake, at Araboe bivouac and Tage Lake. The collected material consisted mainly of small mammals, birds and insects. The specimens were obtained by catching by hand, by nets, traps, and by shooting. The more vulnerable animals (butterflies, birds) were collected by Boschma and his mantris. Other members of the expedition helped with the other material, while some Europeans outside the expedition-staff also gave their assistance. Much material was also obtained from the native population, in exchange for beads, mirrors and cowry-shells, the latter serving as true money. The principal purpose of the expedition was to collect material in order to obtain an insight in the local fauna and its vertical distribution.

Of the shorter collecting trips we wish to mention here Boschma's participation in the excursion of Leiden biology students to Yugoslavia in the summer of 1960, as well as his visit to the coral reefs of the Fiji Islands in March 1949, for collecting material to illustrate the variability of some genera of corals.

To the third category I would like to assign journeys made in order to visit museums and some other institutions for the examination of material for own research.

It may suffice to briefly mention Boschma's visits to the Zoologisch Museum at Amsterdam.

Boschma visited the British Museum (Natural History) in London in March 1935, April-May 1946, January-February 1947, September 1948, September 1949 (then he also viewed a collection in Manchester) and April 1950.

For the same purpose Boschma visited the Muséum National d'Histoire Naturelle in Paris; I found this reported for July 1948, autumn 1950 and September 1954.

In chronological order can further be mentioned Boschma's visit in September and October 1936 to the Museum of Comparative Zoölogy in Cambridge, Mass., to the United Stated National Museum in Washington, D.C., to the American Museum of Natural History in New York and to the Academy of Natural Sciences in Philadelphia. During his stay in Scotland from August till September 1946, Boschma visited the marine biological station at Millport in Great Cumbrae Island, and the Zoological Laboratory in Glasgow, to study corals and insects. During the first months of 1949, after the Pacific Science Congress, Boschma visited several institutions and areas on both islands of New Zealand, then the Fiji Islands, next the Bernice P. Bishop Museum and the marine laboratory of the University of Hawaii in Honolulu; in the United States he visited a few institutions

in San Francisco, Scripps Institution of Oceanography in La Jolla, Calif., and institutions in Corona del Mar and Los Angeles. Subsequently he studied corals in the United States National Museum, Washington, D.C. and in the Museum of Comparative Zoölogy at Cambridge, Mass. In 1961 Boschma visited the Museum of Comparative Zoölogy in Cambridge, Mass., and the Peabody Museum in New Haven, Conn., U.S.A.

2. The Rijksmuseum van Natuurlijke Historie

Boschma has done very much to increase and consolidate the scientific standing of "his" museum. As director, Boschma's position was different from that of his predecessors. His directorate did not include curatorial duties.

Boschma contributed very much to increase and enrich the possessions of the museum in all its departments and he strongly supported the efforts and initiatives of his curators to attain this end. He adopted the current views concerning the importance of certain material and acted accordingly. Since 1948 in his annual reports a new column appeared dealing with acquisitions of material from the faunistic investigations of the Netherlands as well as the results of the collecting-expeditions to New Guinea.

The collections made individually by curators and museum technicians were not brought under the heading "Faunistisch Onderzoek", but the more broadly organized collecting trips in teams to a special area were. Among these are the collecting trips to Vlodrop (province of Limburg), to the area of the Sint Pietersberg in southern Limburg, to Baarle-Nassau (province of Noord Brabant), to a small district near Duurswoude in the Friese Wouden in the province of Friesland, and also continued investigations on the Netherlands marine fauna. The provision of material for faunistic investigations also shows a changed view on the importance of certain material for "museums of natural history". At first — when the museum was established — the ideal was one specimen of each species, restricted to the macroscopic animals; in a subsequent period specimens of both sexes (later also young specimens) of as many species as possible; then all this especially of the national territory; finally extensive material which can reveal the variability of all possible stages of development in a number of localities with divergent ecological circumstances. At the same time the restriction of a thorough investigation into the macroscopic animals is abandoned and the microscopic animals, or the animals of which the microscopic sections are decisive for determining the systematic place, also become part of the museum objects. Boschma himself studied the systematics of the Rhizocephala by means of microscopic sections. These microtome serial sections of his Rhizocephala were usually made outside the museum. During Boschma's directorate,

Dr. A. C. Oudemans presented the museum with his extensive collection of Acarina, consisting of microscopic slides.

The more marked national character of the material in the museum also emerges from the provision of material from the Dutch territories in America and New Guinea; to the latter area collecting journeys were undertaken by personnel of the Museum in the years 1952, 1953/1954 and 1954/1955.

Boschma's concern about the collections of the museum also clearly comes to light in his attitude and his precautions during the war. After the war it could be established that only a small part of the collection was damaged by moisture- and mould-corrosion, caused by lack of fuel for heating. Of a greater extent were the damages and the losses suffered by a bomb hit on 11 December 1944 in the Dubois Collection, which was established outside main building. Through war activities the museum also lost some material lent to institutions in the Netherlands and abroad. Of an entirely different character is the "usual loss" that befalls every museum, on account of the fact that investigators from other museums may make a certain choice from the material for their work. In this way curators supply the museum with material in the group of their own specialty. We would not like to give the epithet "loss" to those cases in which objects are given in exchange for other objects.

During his directorate and also in his report to the Board of Trustees before taking up his office, Boschma persistently advocated the increase of the museum-staff. In his annual reports of 1941 and 1942 Boschma gives a table with the names and the years of service of the 35 scientists who had been on the staff of the museum since its establishment in 1820 (shortly after the Napoleonic period), as well as the names and the years of appointment of the 13 scientists who were on the museum staff in the year under review. In a report on 1936 and 1937 attention was drawn to the fact that in 1933 this staff consisted of one director and four curators. The enlargement to 13 is due to Boschma's efforts to appoint curators for all large systematic groups in order to catalogue the collections and identify them at least provisionally; the way in which the collections are studied highly determines the importance of the museum at home and abroad. Later on the number of curators was again increased by a few. Boschma also pointed out repeatedly that besides the increase in the number of scientific officials, the technical staff should also be expanded (because otherwise too much material remains unprepared) as well as the clerical staff (because otherwise their work befalls upon the curators).

The following is a list of the scientific officials of the Leiden Museum under Boschma's directorate, in sequence of seniority: Dr. G. Stiasny (1919-

1940), Dr. H. C. Blöte (from 1927 onwards), Dr. F. P. Koumans (1928-1947), Dr. C. F. G. H. Bayer (1929-1952), Miss A. M. Buitendijk (1930-1950), Dr. L. D. Brongersma (from 1932 onwards), Dr. G. C. A. Junge (1934-1962), Dr. C. de Jong (1935-1952), Dr. C. O. van Regteren Altena (from 1941 onwards), Dr. W. Vervoort (1941-1946, 1948-1950, and from 1959 onwards), Jhr. W. C. van Heurn (1941-1945), Dr. D. A. Hooijer (from 1941 onwards), Dr. L. B. Holthuis (from 1941 onwards), Dr. L. van der Hammen (from 1946 onwards), Dr. C. J. Keijzer (1946-1957), Dr. M. Boeseman (from 1947 onwards), Dr. G. A. Brouwer (1947-1963), Dr. A. M. Husson (from 1949 onwards), Dr. A. Diakonoff (from 1951 onwards), Dr. M. A. Lieftinck (from 1954 onwards), Dr. C. F. A. Bruyning (1955-1958), Dr. J. T. Wiebes (from 1955 onwards), Dr. G. F. Mees (1955-1956, 1957-1958, from 1963 onwards), Dr. J. van der Vecht (from 1956 onwards).

Besides the persons mentioned above, some younger biologists belonged to the staff for some time, during which they studied small groups of animals in fulfilment of a doctor's or lesser degree. Besides some of the names already listed under the other category we must list here J. A. W. Lucas (1950-1958), H. E. Muller (1955-1956), G. L. Spoek (1955-1956), and D. van der Tooren (1957).

Besides rendering service to science, the museum also did so to the protection of nature: in the annual report for the years 1950-1954 a separate chapter is devoted for the first time to this subject; for this work a capable investigator was added to the staff of the museum.

Like every museum, the Leiden Museum regularly contributed to the education of the public by means of exhibitions. The transfer of the collections and the objects for public exhibition from the old building on the Rapenburg to the new one in the Raamsteeg took place before the wing containing the exhibition rooms was finished. In his annual reports Boschma repeatedly drew attention to this shortcoming. During Boschma's directorate, the only room available for the public was a room showing a general survey of the Dutch fauna. This collection was comparatively well visited; however, it had to be closed in 1950, because of insufficient supervision. During the holiday months temporary exhibitions were occasionally held in the meeting room in the main wing. In 1937 a shed in the garden of the museum was used for the exhibition of the skeletons of two sperm whales which had stranded in The Netherlands shortly before.

For many years anticipations were focused on a fair-sized room for exhibitions in the building of a former secondary school, next to the museum, or to house the exhibits in a new building to be built there after tearing down

the old school. The annual report for 1930-1935 already mentioned these plans, which were discussed with the Government Architect in May 1939. During the war, however, the building in question was partly placed at the disposal of the Netherlands Red Cross and after that occupied by the Labour Exchange; the expectation that after the German occupation this situation would soon come to an end was not materialized. When Boschma resigned his office, there was still no public exhibition room in the old school building; a number of rooms in this building then contained parts of the Dubois Collection, which were transferred there when the building in the Steenstraat had incurred bomb-damage.

The above-mentioned meeting-room was mostly used by the professor, reader and lecturers of the museum for giving lectures. Boschma fully co-operated in making the meeting-room available for meetings of societies working in the field of natural history and related sciences. Through this the museum and its collections got a place in the life of the Dutch professional and amateur biologists, who are members of the Nederlandsche Dierkundige Vereeniging (Netherlands Society for Zoology), the Nederlandsche Entomologische Vereeniging (Netherlands Society for Entomology), the Nederlandsche Ornithologische Vereeniging (Netherlands Society for Ornithology), the Nederlandsche Malacologische Vereeniging (Netherlands Society for Malacology), the Leiden section of the Koninklijke Nederlandsche Natuurhistorische Vereeniging (Royal Netherlands Society of Natural History) and the Natuurkundig Gezelschap (Society of Natural Sciences) of Leiden. These and similar parties of specialists and amateurs were, if the opportunity presented itself, shown the collections in the rooms that were not open to the public. In this way visitors to the International Congress of Entomology, held in Amsterdam in 1951, had admission to the non-public collections, as has any visiting scientist.

Part from what took place and did not take place and apart from the official report, we would refer to a meeting of directors and staffmembers of museums in The Netherlands, held in 1949, where Boschma spoke about his museum, extended and equipped according to his ideals of a museum in his field of science. In this address, which was published later, he argues that a museum like his has the following four functions.

a) The preservation of an exhibition for the public.

b) The setting up of "archives" by collecting, arranging and preserving material, and keeping it in good condition. In the first place the type material of the species, so that other material of the same and other species can always be compared with it. This type material can be increased by scientific study of the collections and acquisitions of the museum itself, as well

as by elaborating collections borrowed from other museums, whereby some material from the collection may be kept by way of compensation. Besides the type material there is the preservation of as much other material as is possible, showing variations of the species, which variations must be known in order to determine the limits of the species, the geographical subspecies, etc. This necessary and desired material can be obtained by taking part in expeditions, collecting trips, excursions, etc. For curators charged with the study of variable species, it is of great importance to acquaint themselves with this variability on the spot in natural surroundings. Moreover, the material of the museum can be increased by acquiring collections from private persons, institutes that have no proper function as museum, by purchase, gifts, etc.

c) The registration and, what is more important, the scientific investigation and description of the material present. In many cases this is only possible if at the same time the same is done with similar material borrowed for this purpose. A museum which is of the size and importance as the Leiden museum, would require a large number of curators, more than the ten his museum then had for studying recent material. Boschma mentions the names of 17 groups that would need at least one scientific keeper each — some divisions definitely more —, irrespective of the groups not mentioned. The visits made by curators to other museums are also essential for comparing type material, for examining supplementary material, for consulting with colleagues.

d) The instruction of outsiders (local museums, owners of private collections, institutes with a different set-up) on material and on matters of nomenclature. Sometimes this instruction can be given at once, sometimes extensive inquiries must be made, sometimes a specialist must be found elsewhere.

As to the relationship of a scientific zoological museum with students, future colleagues, the University and the Board of Trustees, Boschma's opinions are the following:

1) The ties between a zoological museum and a university have the advantage that they help to excite the students' interest in systematic zoology, to encourage them to make themselves capable in this direction, e.g. by carrying out investigations or by writing a thesis; this creates a greater choice from which to select new staff members when a vacancy has to be filled.

2) A scientific museum with its statical and highly conservative character (which character remains, in spite of the impregnating effect of new tendencies in zoology in general) should not have too close relations with a

university and should not form part of a university, for, owing to its many institutes, the real character of a university is a dynamic one and therefore "highly subject to the prevailing whims of science".

3) The "board of trustees" of scientific museums should for the greater part consist of persons who have an understanding of the needs of such museums.

3. Editorships of zoological journals

During his directorate of the museum Boschma acted as editor of the official periodicals of the museum. These are the Zoologische Mededelingen, the Zoologische Verhandelingen and the Zoologische Bijdragen, all three with the notice "uitgegeven door het Rijksmuseum van Natuurlijke Historie te Leiden".

By virtue of his office, Boschma was editor of the Zoologische Mededelingen, like the previous museum-director. This editorship beside his directorate lasted from volume XVII (1934) up to and including volume XXXV (1957). The issues of the journal Zoologische Verhandelingen, likewise published by the museum and set up under Boschma's directorship, contain more extensive articles. Of this journal the numbers 1 in 1948 up to and including 36 in 1958 appeared under Boschma's editorship. The Zoologische Bijdragen contain articles for a wider public; the numbers 1, 2 and 3 in the years 1955, 1956 and 1958 were edited by Boschma during his directorship. No. 4 came out when his successor, Dr. L. D. Brongersma, was director.

Besides these three periodicals published by the museum, Boschma also edited the journal "Temminckia. A Journal of systematic zoology"; on the title-pages of volume I of 1936 to volume X of 1960 inclusive we read that Boschma, director of the Rijksmuseum van Natuurlijke Historie, is the editor.

Boschma was co-editor of the journal Tijdschrift der Nederlandsche Dierkundige Vereeniging, later with the changed title Archives néerlandaises de Zoologie, from 1932 until 1940, and from 1945 until 1947.

Furthermore Boschma is on the editorial board of the journal "Crustaceana, International Journal of Crustacean Research", since its first appearance in 1960.

4. Editorship of the series Fauna van Nederland

In co-operation with a few other Dutch zoologists Boschma established a series in 1927, the issues of which are devoted to a systematic treatment of separate animal groups, as far as they occur in The Netherlands. The first part, however, published by Boschma in 1927, contains a zoogeographical-faunistical introduction. From 1927 up to 1956 16 issues appeared. The

authors were, in alphabetical order: Miss T. van Benthem Jutting, H. C. Blöte, H. Boschma, Miss A. M. Buitendijk, R. van Eecke, H. Engel, A. A. de Groot, J. Heimans, L. B. Holthuis, H. R. Hoogenraad, P. N. van Kampen, H. C. Redeke, J. van der Vecht and W. Vervoort.

The other zoologists on the editorial board were L. F. de Beaufort, P. N. van Kampen, E. D. van Oort, H. C. Redeke and W. Roepke; in the course of years four of them died and their names had to be omitted from the title-page.

In the hitherto published issues on the fauna of The Netherlands the following systematic groups have been subjected to a systematic-faunistical elaboration: fresh-water Rhizopoda and fresh-water Heliozoa, Hydroid polyps, Decapoda, Isopoda and Tanaidacea, Collembola, Thysanoptera, Homoptera, *Andrena,* Gastropoda Prosobranchia et Pulmonata, Gastropoda Opisthobranchia, Amphineura, Scaphopoda, Lamellibranchiata, Echinodermata, Pisces (Cyclostomi-Euichthyes), Amphibia et Reptilia.

5. Chairmanships and memberships of working committees in the field of nomenclature

It was in 1947 that Boschma, as a member of the International Commission on Zoological Nomenclature, went to London for discussions with Mr. Francis Hemming, secretary of the said commission.

Also during his voyage to New Zealand and back via the U.S.A., in 1949, Boschma acted as a member of this commission and conferred with its American members and with the Washington Nomenclature Discussion Group. Similar discussions took place with entomologists in Ottawa, Canada, and in Cambridge, Mass., U.S.A.

As chairman of the new Standing Committee for Systematic Zoology Boschma made its report at the 8th Pacific Science Congress in 1953.

6. Textbook articles

In proportion to the extent of Boschma's task of teaching biology and geology students, the number of articles that he wrote in textbooks and handbooks is comparatively small.

We mention here the subjects which he was charged to deal with and which are of a small extent compared with the subjects treated by other authors, viz. in a textbook of special and systematic zoology (1928) the chapter on Porifera (sponges) and in a textbook of general zoology (1929) the chapter on ecology.

Finally we refer to his contributions on "Hydrocorallia" in the Treatise on Invertebrate Paleontology, edited by Raymond C. Moore.

7. Tuition and education

Boschma's official entrance as university teacher took place in the autumn of 1923, when he was appointed lecturer in the comparative ontogeny of the Invertebrata (for 2nd and 3rd year biology students). In December 1925 Boschma became in addition a lecturer for teaching zoology to medical students.

On 1st July 1928 he was appointed reader in zoology.

When in June 1934 his professorship was changed into that of systematic zoology, Boschma retained the lectures on general morphology and systematics of the Invertebrata. It was now for the first time in the history of Leiden University that part of the tuition by the professor of systematic zoology became a compulsory subject matter for examinations. In the same year, compulsory practical lessons in Dutch faunistics were introduced for second-year biology students. For these lessons Boschma was assigned a paid assistant starting 1 October 1934. Before the German occupation D. J. Kuenen and R. J. van der Linde were assistants, after the occupation C. F. A. Bruyning, P. H. Creutzberg, W. van Ree, A. C. Perdeck, A. C. van Bruggen, H. E. Muller and W. van Laar. It is a remarkable phenomenon that the majority of these assistants developed into ecologists and not into systematists: a further study of faunistics cannot be a bad training for the ecologist. Besides these teaching assistants, Boschma also had other assistants, like A. F. Wilmink, Miss J. M. van Roon, L. van der Hammen, Miss M. N. van Tilburg, A. M. Husson, Miss N. Croin Michielsen, and J. Mennema, who mostly rendered their services in the bird banding administration.

The prevailing opinion about the significance of lectures and practical courses in the biological branches in relation to those in the non-biological branches in the first years of the biology study, is expressed by Boschma in 1953, in a (later published) address to freshmen biology students. The lectures and practical courses in non-biological branches demand a great deal of time and attention, and they do not leave much opportunity to the students to use their spare time to become acquainted with the flora and fauna in the open field. Boschma fully understands how difficult this is for amateur-naturalists who want to proceed on such experiences; their relationship towards the study is different from those who are more interested in work in the laboratory, especially in experimental work.

During Boschma's professor-directorship, the relation of the number and size of the available lecture-rooms and other resources of the museum, as

well as the relation of the financial means of the museum to those necessary for university education, was arranged on a basis of principle. As Boschma phrased it, the Museum afforded hospitality to the University for the teaching of systematic zoology, by lending the meeting room for lectures and by lending the former "skull-room" for the second-year practical courses. This room could also be used by future candidates for a doctor's degree who had chosen an investigation for their final examination. These changed possibilities to study representatives of the various groups of the animal kingdom cancelled the need and importance of a so-called "teaching-collection", as had been established and arranged in some rooms on the ground-floor at the request of the then professor of general zoology, P. N. van Kampen, but which had never served its purpose; for this reason that collection was removed in May 1931. Apart from the financial means of the museum, there was also a subsidy for the tuition of systematic zoology, from which subsidy could be purchased animals for cursory practical lessons, handbooks, binocular microscopes, etc.

For the final examination in biology the candidates had a considerable freedom of choice of subjects for investigation. It should be noted that comparatively many intending examinees chose an investigation in the museum under Boschma's personal supervision, in spite of the fact that Boschma demanded a minimum of six months for such an investigation. For advanced students Boschma lectured for some years on subjects in the field of systematic biology and other more special subjects of systematic-zoological character.

There is a great number of theses whereby Boschma presented the candidates for their degrees. We do right in dividing these theses into three categories: Firstly, theses outside Boschma's direct interest, whereby in his function of professor he presented the candidate for his degree; these are chiefly theses written under the supervision of colleagues in and outside Leiden (1931-1939). A second class of theses were achieved under Boschma's supervision, but they do not deal with systematic zoology. They rather concern what might be called biological-ecological investigations; in this field too, Boschma stimulated research (1931-1935). The third class of theses, by far the largest of the three, contains those in the field of systematic zoology and related subjects; these were presented and accepted on the authority of Boschma and prepared under his general supervision, although some were written under the direct supervision of other specialists (1935-1963).

The list of theses whereby Boschma presented the candidates for their degrees are the following in chronological order:

1931 (6 October). H. J. de Fluiter. De bloedluis Eriosoma lanigerum (Hausm.) in Nederland.
1931 (13 October). E. M. Kruytzer. De ontwikkeling van het chondrocranium en enkele kopzenuwen van Megalophrys montana.
1932 (26 January). Miss E. Rietra. Iets over den bouw en de levenswijze van Nemeritis canescens (Gravenhorst) als interne parasiet van de larve van Ephestia Kuehniella Zeller.
1932 (12 April). N. Tinbergen. Ueber die Orientierung von Philanthus triangulum Fabr.
1932 (3 May). M. Eisma. De differentiatie van het derde stadium van de larven der Ancylostomidae van mensch, hond en kat.
1933 (17 November). Miss C. J. S. Locher. Untersuchungen über den Farbensinn von Eichhörnchen.
1933 (15 December). J. van der Vecht. De groote peperwants of semoenjoeng (Dasynus piperis China).
1934 (18 May). Miss J. Muller. The orbitotemporal region of the skull of the Mammalia.
1934 (13 July). Miss K. Schijfsma. Observations on Hydractinia echinata (Flem.) and Eupagurus bernhardus (L.).
1935 (17 January). B. A. Dorsman. Notes on the life-history of Orchestia bottae Milne Edwards.
1935 (2 May). H. C. Blöte. Remarks on biogeography.
1935 (5 July). J. H. Diemer. Over biotypen van Anopheles maculipennis Meigen, in het bijzonder in westelijk Nederland. Een taxonomisch onderzoek.
1935 (22 November). C. J. Keijzer. On variability in East Indian Foraminifera.
1936 (17 June). J. L. L. F. Hartkamp. Onderzoekingen over een laesieverschijnsel bij Paramecium caudatum.
1936 (5 November). G. J. Broekhuysen. On development, growth and distribution of Carcinides maenas (L.).
1937 (29 April). I. van Baal. Rhizocephala of the families Peltogastridae and Lernaeodiscidae. Biological Results of the Snellius Expedition. II.
1938 (5 October). M. J. van Erp Taalman Kip. Lichaamsgrootte en hersenschors.
1938 (15 November). Miss A. Gijzen. 's Rijks Museum van Natuurlijke Historie 1820-1915.
1938 (22 November). C. de Jong. On indo-malayan Pterophyllinae.
1939 (16 June). D. J. Kuenen. Systematical and physiological notes on the brine shrimp, Artemia.
1940 (24 September). J. Verseveldt. Studies on Octocorallia of the families Briareidae, Paragorgiidae and Anthothelidae.
1941 (26 June). H. Schilp. The Chaetognatha of the Snellius Expedition.
1946 (23 January). L. B. Holthuis. The Decapoda Macrura of the Snellius Expedition. I.
1946 (6 February). W. Vervoort. The Copepoda of the Snellius Expedition. I.
1946 (27 February). D. A. Hooijer. Prehistoric and fossil Rhinoceroses from the Malay Archipelago and India.
1946 (16 October). J. W. B. van der Stigchel. South American Nematognathi.
1947 (26 March). M. Boeseman. Revision of the fishes collected by Burger and von Siebold in Japan.
1948 (18 February). C. F. A. Bruyning. Studies on Malayan Blattidae.
1949 (16 November). H. W. Parker. The snakes of Somaliland and the Sokotra Islands.
1951 (19 September). H. H. J. Nesbitt. A taxonomic study of the Phytoseiinae (family Laelaptidae) predaceous upon Tetranychidae of economic importance.
1952 (8 October). L. van der Hammen. The Oribatei (Acari) of the Netherlands.
1954 (20 January). G. A. Brouwer. Historische gegevens over onze vroegere ornithologen en over de avifauna van Nederland.

1956 (10 October). D. N. Ray Chaudhuri. Revision of Greenidea and related genera (Homoptera, Aphididae).
1957 (16 October). G. F. Mees. A systematic review of the indo-australian Zosteropidae (Part I).
1957 (30 October). A. C. Perdeck. The isolating value of specific song patterns in two sibling species of grasshoppers (Chorthippus brunneus Thunb. and C. biguttulus L.).
1958 (2 July). Marjorie Ellen Maclaggan (Mrs. M. E. Macgillivray). A study of the genus Masonaphis Hille Ris Lambers, 1939 (Homoptera, Aphididae).
1962 (28 November). A. M. Husson. The bats of Suriname.
1963 (15 May). J. T. Wiebes. Taxonomy and host preferences of indo-australian fig wasps of the genus Ceratosolen (Agaonidae).

Distinctions

Finally we wish to mention the honours that were awarded to Boschma. Among these we do not include the facts mentioned before, such as his appointment as assistant, principal assistant, lecturer, reader, professor, and director of the Rijksmuseum van Natuurlijke Historie, although we do realize that all these ranks in the social scale were just as many "personal distinctions". Neither will we repeat here what was said above his being delegated by the government, or by Leiden University to international congresses. Here we will refer to the other "personal distinctions", which are not a direct logical consequence of his social career, but which are to be understood as more direct "personal" recognitions.

Of these "personal distinctions" we wish to mention the following: the predicate "cum laude" when he received his degree as doctor in botany and zoology (1920); member of the Provinciaal Utrechtsch Genootschap (1932); representative of the Rijksmuseums of Leiden at the celebration of the 300th anniversary of the Muséum National d'Histoire Naturelle in Paris (June 1935); representative of the Rijksuniversiteit of Leiden at the celebration of the 300th anniversary of Harvard University in Cambridge, Mass., U.S.A. (1936); member of the Hollandsche Maatschappij der Wetenschappen, Haarlem (1938); award of the commemorative medal of H. M. King Leopold of Belgium (in connection with the study of material collected by the King) (1938); representative of the Senate of the Rijksuniversiteit at Leiden at the celebration of the 200th anniversary of Lamarck's birthday, Paris (1946); ordinary member of the Koninklijke Nederlandse Akademie van Wetenschappen, Amsterdam (1946); Foreign Member of the Linnean Society of London (1946); member of the International Commission on Zoological Nomenclature (1947); chairman of the Joint Commission on Oceanography (1947); correspondent and honorary collaborator of 's Lands Plantentuin, Buitenzorg (1947); member of the permanent Committee of the International Zoological Congresses (1948); corresponding member of

the Zoological Society of London (1948); chairman of the new Standing Committee for Systematic Zoology of the 7th Pacific Science Congress in New Zealand (1949); member of the Committee on Projects for the Pacific Science Congress (1949); chairman of the Standing Committee for Systematic Zoology of the Pacific Science Council (1950); membre d'honneur of the Société Zoologique de France (1950); Foreign Fellow of the Zoological Society of London (1951); member of the Commissie van Advies van de Natuurhistorische Musea in Nederland (Advisory Board of the Netherlands Museums of Natural History) (1954); Honorary Corresponding Fellow of the Zoological Society of India (1955); Honorary Fellow of the Academy of Zoology at Agra, India (1955); Ridder in de Orde van de Nederlandse Leeuw (1959); correspondant de l'Académie des Sciences de l'Institut de France (1961).

Bibliography

The following list enumerates Boschma's publications arranged in various categories. I have tried to make this list as complete as possible, but realize that several items may have been overlooked.

A. Publications in the field of biological sciences

I. Protozoa

1948. Sur les organelles d'absorption chez une espèce d'Amallocystis (Protozoa, Ellobiopsidae). Proc. Kon. Nederl. Akad. Wetensch., vol. 51 no. 4, pp. 446-449.

1949. Ellobiopsidae. Discovery Rep., vol. 25, pp. 281-314, pls. 38-41.

1957. Ellobiopsidae. Cons. Int. Explor. Mer, Zooplankton Sheet 65, pp. 1-4.

1959. Ellobiopsidae from tropical West Africa. Atlantide Rep., vol. 5, pp. 145-175.

II. Porifera

1928. Porifera (sponsen). In: J. E. W. IHLE & H. F. NIERSTRASZ, Leerboek der bijzondere dierkunde, pp. 57-67. Oosthoek, Utrecht.

III. Coelenterata

1. Corals in general

1936. Groei van koraaldieren. Natuur en Mens, vol. 56, pp. 184-186.

1936. Sur la croissance de quelques coraux des récifs de l'île d'Edam (baie de Batavia). Mém. Mus. Roy. Hist. nat. Belg. (= Verhand. Kon. natuurhist. Mus. België), ser. 2 vol. 3 (= Mélanges Paul Pelseneer), pp. 101-114.

1950. Notes on the coral reefs near Suva in the Fiji Islands. Proc. Kon. Nederl. Akad. Wetensch., vol. 53 no. 3, pp. 294-298.

1959. The species problem in corals. Proc. XVth Int. Congr. Zool., pp. 246-248.

2. "Hydrocorallia" (Milleporina, Stylasterina)

1948. Specific characters in Millepora. Proc. Kon. Nederl. Akad. Wetensch., vol. 51 no. 7, pp. 818-823, 1 pl.

1948. The species problem in Millepora. Zool. Verhand. Leiden, no. 1, pp. 1-115, pls. 1-15.

1948. Het soortprobleem bij Millepora. Versl. Kon. Nederl. Akad. Wetensch., vol. 57 no. 4, pp. 2, 3.

1949. The ampullae of Millepora. Proc. Kon. Nederl. Akad. Wetensch., vol. 52 no. 1, pp. 3-14, pls. 1-5.
1949. Notes on specimens of the genus Millepora in the collection of the British Museum. Proc. zool. Soc. London, vol. 119 pt. 3, pp. 661-672, pls. 1, 2.
1950. Further notes on the ampullae of Millepora. Zool. Meded. Leiden, vol. 31 no. 5, pp. 49-61, pls. 1-6.
1951. Notes on Stylasterina (Hydrocorallia). Proc. Kon. Nederl. Akad. Wetensch., ser. C vol. 54 no. 5, pp. 451-458.
1951. On a specimen of Distichopora brasseyae Wright (Hydrocorallia, Stylasterina). Proc. Kon. Nederl. Akad. Wetensch., ser. C vol. 54 no. 5, pp. 459-463.
1951. Notes on Hydrocorallia. Zool. Verhand. Leiden, no. 13, pp. i, ii, 1-49, pls. 1, 2.
1953. The Stylasterina of the Pacific. Zool. Meded. Leiden, vol. 32 no. 16, pp. 165-184.
1953. Notes on specimens of Stylaster mooraboolensis (Hall) in the collection of the Manchester Museum. Proc. Kon. Nederl. Akad. Wetensch., ser. B vol. 56 no. 4, pp. 355-363, 1 pl.
1953. Linnaeus's description of the stylasterine coral Errina aspera. I. Proc. Kon. Nederl. Akad. Wetensch., ser. C vol. 56 no. 3, pp. 301-310.
1953. Linnaeus's description of the stylasterine coral Errina aspera. II. Proc. Kon. Nederl. Akad. Wetensch., ser. C vol. 56 no. 3, pp. 311-316.
1953. Over enkele noorsche koralen. Versl. Kon. Nederl. Akad. Wetensch., vol. 62 no. 4, pp. 32-35.
1954. Stylasterina in the collection of the Amsterdam Museum. I. Errina aspera (L.). Proc. Kon. Nederl. Akad. Wetensch., ser. C vol. 57 no. 2, pp. 143-150, pls. 1-3.
1954. De familie Axoporidae. Versl. Kon. Nederl. Akad. Wetensch., vol. 63, pp. 99-104.
1955. The specific characters of the coral Stylaster roseus. Papers in Marine Biology and Oceanography. Deep-Sea Research, vol. 3 suppl., pp. 134-138.
1955. The type specimen of Stylaster gemmascens (Esper, 1794). Proc. Kon. Nederl. Akad. Wetensch., ser. C vol. 58 no. 1, pp. 22-31, pls. 1, 2.
1956. Milleporina and Stylasterina. In: R. C. Moore, Treatise on Invertebrate Paleontology, part F (Coelenterata), pp. F90-F106.
1956. Distichopora gracilis Dana. Stylasterina in the collection of the Paris Museum I. Proc. Kon. Nederl. Akad. Wetensch., ser. C vol. 59 no. 2, pp. 137-143, pls. 1-4.
1956. The stylasterine coral Allopora incompleta Tenison-Woods. Proc. Kon. Nederl. Akad. Wetensch., ser. C vol. 59 no. 2, pp. 144-153, pls. 1-3.
1956. Notes on the stylasterine coral Allopora nobilis Kent. Proc. Kon. Nederl. Akad. Wetensch., ser. C vol. 59 no. 2, pp. 154-164, pls. 1-3.
1956. Errina amoena nov. spec. Stylasterina in the collection of the Paris Museum II. Proc. Kon. Nederl. Akad. Wetensch., ser. C vol. 59 no. 3, pp. 281-289, pls. 1-3.
1957. Stylaster flabelliformis (Lamarck). Stylasterina in the collection of the Paris Museum III. Zool. Meded. Leiden, vol. 35 no. 19, pp. 261-282, pls. 10-13.
1957. List of the described species of the order Stylasterina. Zool. Verhand. Leiden, no. 33, pp. 1-72.
1958. Proposed use of the plenary powers to validate the specific name "gemmascens" Esper, [1794], as published in the combination "Madrepora gemmascens" (Class Hydrozoa, Order Stylasterina). Bull. zool. Nomencl., vol. 16 no. 2, pp. 71, 72.
1959. Revision of the Indo-Pacific species of the genus Distichopora. Bijdr. Dierk. Amsterdam, vol. 29, pp. 121-171, pls. 1-16.
1960. Opmerkingen over een Zuidafrikaanse Stylasteride. Versl. Kon. Nederl. Akad. Wetensch., vol. 69 no. 4, pp. 54, 55.
1960. Notes on the stylasterine coral Allopora profunda Moseley. Proc. Kon. Nederl. Akad. Wetensch., ser. C vol. 63 no. 3, pp. 400-407, pl. 1.
1960. Gyropora africana, a new stylasterine coral. Proc. Kon. Nederl. Akad. Wetensch., ser. C vol. 63 no. 4, pp. 423-434, pls. 1, 2.

1960. The stylasterine coral Allopora bithalamus (Broch). Proc. Kon. Nederl. Akad. Wetensch., ser. C vol. 63 no. 4, pp. 435-446, pls. 1-3.
1960. The stylasterine coral Allopora stellulata (Stewart). Zool. Meded. Leiden, vol. 37 no. 4, pp. 49-60, pls. 3-6.
1961. Notes on Millepora braziliensis Verrill. Proc. Kon. Nederl. Akad. Wetensch., ser. C vol. 64 no. 3, pp. 292-296, pls. 1, 2.
1961. Stylasterina. Campagne de la "Calypso": Golfe de Guinée. Ann. Inst. océanogr. Paris, vol. 39, pp. 193-225, pls. 3-6.
1962. Notes on the stylasterine coral Allopora miniata. Proc. Kon. Nederl. Akad. Wetensch., ser. C vol. 65 no. 3, pp. 195-204, pls. 1, 2.
1962. Notes on Stylaster lonchitis Broch. Proc. Kon. Nederl. Akad. Wetensch., ser. C vol. 65 no. 4, pp. 287-293, pls. 1, 2.
1962. On Milleporine corals from Brazil. Proc. Kon. Nederl. Akad. Wetensch., ser. C vol. 65 no. 4, pp. 303-312, pls. 1-8.
1963. The generic name Axopora. Proc. Kon. Nederl. Akad. Wetensch., ser. B vol. 66 no. 3, pp. 107-117.
1963. Notes on species of the genus Axopora. Proc. Kon. Nederl. Akad. Wetensch., ser. B vol. 66 no. 3, pp. 118-129, pls. 1-8.
1963. On the stylasterine genus Errina, with the description of a new species. Proc. Kon. Nederl. Akad. Wetensch., ser. C vol. 66 no. 4, pp. 331-344.

3. Anthozoa (systematics, feeding, symbiosis, ontogeny, budding, coalescence)

1922. Knopvorming en vergroeiing van knoppen bij Fungia fungites en Fungia actiniformis. Versl. Kon. Akad. Wetensch., vol. 30 nos. 6, 7, pp. 331-343.
1922. On budding and coalescence of buds in Fungia fungites and Fungia actiniformis. Proc. Kon. Akad. Wetensch., vol. 24 nos. 6, 7, pp. 257-268.
1923. Fungia patella. The Madreporaria of the Siboga Expedition. Part IV. Siboga Exped., mon. 16d, pp. i-viii, 129-152, pls. 9, 10.
1923. Ueber die Bildung der jungen Kolonien von Goniopora stokesi durch ungeschlechtliche Fortpflanzung. Zool. Anz., vol. 57, pp. 284-286.
1923. Experimental budding in Fungia fungites. Proc. Kon. Akad. Wetensch., vol. 26 nos. 1, 2, p. 88-96, pls. 1, 2.
1923. Knospung und verwandte Erscheinungen bei Fungia fungites und Fungia actiniformis. Treubia, vol. 3 no. 2, pp. 149-179, pls. 7-19.
1923. Experimenteele knopvorming bij Fungia fungites. Versl. Kon. Akad. Wetensch., vol. 32 no. 1, pp. 85-94, pls. 1, 2.
1923. Het voedsel der Madreporaria. Versl. Kon. Akad. Wetensch., vol. 32 no. 9, pp. 905-916.
1924. On two different growth-forms of Merulina laxa Dana. Zool. Meded. Leiden, vol. 8, pp. 36-38, pl. 1.
1924. On the food of Madreporaria. Proc. Kon. Akad. Wetensch., vol. 27 nos. 1, 2, pp. 13-23.
1924. Regeneration und Knospung bei koloniebildenden Fungiden. Tijdschr. Nederl. Dierk. Ver., ser. 2 vol. 19, pp. 56-60.
1925. On the feeding reactions and digestion in the coral polyp Astrangia danae, with notes on its symbiosis with zoöxanthellae. Biol. Bull. Woods Hole, vol. 49 no. 6, pp. 407-439.
1925. Studies on anthozoan polyps. Yearbook Carnegie Inst., no. 24, pp. 223, 224.
1925. Fungiidae. Madreporaria I. Papers from Dr. Th. Mortensen's Pacific Expedition 1914-16. XXVIII. Vidensk. Medd. Dansk naturh. Foren., vol. 79, pp. 185-259, pls. 5-11.

1925. On the symbiosis of certain Bermuda Coelenterates and Zooxanthellae. Proc. Amer. Acad. Arts Sci., vol. 60, pp. 451-460.
1925. The nature of the association between Anthozoa and Zooxanthellae. Proc. Nat. Acad. Sci., vol. 11, pp. 65-67.
1926. On the food of reef corals. Proc. Kon. Akad. Wetensch., vol. 29 no. 7, pp. 993-997.
1926. Over het voedsel der rifkoralen. Versl. Kon. Akad. Wetensch., vol. 35 no. 6, pp. 713-718.
1928. An unusual manner of budding in Echinopora lamellosa (Esper). Papers from Dr. Th. Mortensen's Pacific Expedition 1914-16. XLI. Vidensk. Medd. Dansk naturh. Foren., vol. 85, pp. 1-6, pl. 1.
1929. On the food of reef corals and some other Coelenterates. C. R. Xme Congr. Int. Zool., vol. 2, pp. 920-923.
1929. On the postlarval development of the coral Maeandra areolata (L.). Pap. Tortugas Lab. Carnegie Inst. Washington, vol. 26 no. 391, pp. 129-147.
1929. The Fungidae (Anthozoa) collected by Mr. Cyril Crossland at Tahiti and neighbouring islands. Proc. zool. Soc. London, 1929, pp. 43-47, pl. 1.
1930. H. BOSCHMA & J. VERWEY, The occurrence of stalked buds in the coral Echinopora lamellosa (Esper). Treubia, vol. 12 no. 2, pp. 129-132, pls. 1-5.
1934. On the septal arrangement in fungid corals. Proc. fifth Pacif. Sci. Congr., pp. 4199-4206.
1936. Koralen. Voordr. Maatschappij Diligentia 's Gravenhage, 1936, pp. 22-33.
1951. The coral Montipora monasteriata (Forsk.) in the Fiji Islands. Zool. Meded. Leiden, vol. 31, pp. 89-94.
1951. Deling bij Tubastrea. Versl. Kon. Nederl. Akad. Wetensch., vol. 60 no. 5, pp. 44-46.
1952. Madreporarian corals of the genus Notophyllia. Proc. Kon. Nederl. Akad. Wetensch., ser. C vol. 55 no. 3, pp. 238-247, pl. 1.
1952. Het septale systeem van Notophyllia. Versl. Kon. Nederl. Akad. Wetensch., vol. 61 no. 4, pp. 47, 48.
1953. On specimens of the coral genus Tubastraea, with notes on phenomena of fission. Stud. Fauna Curaçao Caribb. Isl., vol. 4, pp. 109-119, pls. 9-12.
1954. On some specimens of the coral Montipora verrucosa (Lamarck) from the Hawaiian Islands, formerly described as separate species. Proc. Kon. Nederl. Akad. Wetensch., ser. C vol. 57 no. 2, pp. 151-158, 1 pl.
1959. The stony corals described by Rumphius. In: H. C. DE WIT (ed.), Rumphius Memorial Volume, pp. 249-276.
1961. Acropora Oken, 1815 (Anthozoa, Madreporaria); proposed validation under the plenary powers. Z.N.(S.) 1036. Bull. zool. Nomencl., vol. 18 no. 5, pp. 334, 335.

IV. Arthropoda

1. Crustacea Cladocera and Cirripedia (exclusive of Rhizocephala)

1948. Elminius modestus in the Netherlands. Nature, London, vol. 161, p. 403.
1949. Penilia avirostris Dana (Crustacea Cladocera) in het kustgebied van Nederland. De Levende Natuur, vol. 52 no. 8, p. 159.

2. Rhizocephala (systematics, morphology, larvae)

1925. P. N. VAN KAMPEN & H. BOSCHMA. Die Rhizocephalen der Siboga-Expedition. Siboga Exped., mon. 31bis, pp. 1-61.
1925. Rhizocephala of Curaçao. Bijdr. Dierk. Amsterdam, vol. 24, pp. 9-14, pl. 2.
1927. Ueber europäische Formen der Gattung Sacculina. Zool. Jb. Syst., vol. 54, pp. 39-86.
1927. Bemerkungen über Rhizocephalen des Golfes von Neapel. Pubbl. Staz. Zool. Napoli, vol. 8 no. 2, pp. 261-272.

1927. On the larval forms of Rhizocephala. Proc. Kon. Akad. Wetensch., vol. 30 no. 2, pp. 293-297.
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1928. Rhizocephala. In: R. SPÄRCK (ed.), Zoology of the Faroes, vol. 28, pp. 1-3.
1928. Rhizocephala. The Danish Ingolf Exped., vol. 3 no. 10, pp. i-iv, 1-52, 1 chart.
1928. The Rhizocephala of the Leiden Museum. Zool. Meded. Leiden, vol. 11 nos. 2, 3, pp. 146-176.
1928. Two common species of parasitic Crustacea (Sacculinidae) of the West Indies. Proc. U.S. Nat. Mus., vol. 73 no. 5, pp. 1-10.
1929. Galatheascus striatus, a new Rhizocephalan. Journ. mar. biol. Ass. U.K., n. ser. vol. 16 no. 1, pp. 73-79.
1930. Briarosaccus callosus, a new genus and new species of a rhizocephalan parasite of Lithodes agassizii Smith. Proc. U.S. Nat. Mus., vol. 76 no. 7, pp. 1-8.
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1931. Rhizocephala. Papers from Dr. Th. Mortensen's Pacific Expedition 1914-16. LV. Vidensk. Medd. Dansk naturh. Foren., vol. 89, pp. 297-380.
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1933. The Rhizocephala in the collection of the British Museum. Journ. Linn. Soc. London Zool., vol. 38 no. 261, pp. 473-552, pl. 7.
1933. Ligella, a nomen nudum. Correction to Papers from Dr. Th. Mortensen's Pacific Expedition 1914-16. LV. Rhizocephala. Vidensk. Medd. Dansk naturh. Foren., vol. 93, pp. 169, 170.
1933. Note on the Rhizocephala in the collection of the British Museum. Note on the results of the Snellius Expedition. Proc. Linn. Soc. London, 1933, pp. 24-27.
1933. New species of Sacculinidae in the collection of the United States National Museum. Tijdschr. Nederl. Dierk. Ver., ser. 3 vol. 3, pp. 219-241.
1933. Soortsproblemen en biologische relaties bij Rhizocephalen. Vakblad Biologen, vol. 14 no. 11, pp. 225-236.
1934. Rhizocéphales (Supplément). Résultats scientifiques du voyage aux Indes Orientales Néerlandaises de LL.AA.RR. le Prince et la Princesse Léopold de Belgique. Mém. Mus. Roy. Hist. nat. Belg. (= Verhand. Kon. natuurhist. Mus. België), hors ser. vol. 3 no. 16, pp. 1-8.
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1936. Sur la Sacculina carpiliae et la Sacculina leptodiae, de Guérin Ganivet. Bull. Mus. Hist. nat. Paris, ser. 2 vol. 8, pp. 342-344.
1936. The specific characters of Sacculina rotundata Miers and Sacculina yatsui nov. spec. Zool. Meded. Leiden, vol. 19, pp. 1-22.
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1938. Loxothylacus nierstraszi, a new species of rhizocephalan parasite from the East Indies. Arch. Néerl. Zool., vol. 3 suppl., pp. 17-21.
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IX. Systematics and nomenclature

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XI. Ecology

1929. Oecologie. In: J. E. W. IHLE and H. F. NIERSTRASZ, Leerboek der algemeene dierkunde, pp. 233-280. Oosthoek, Utrecht.

XII. Economic aspect of zoology

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C. Publications concerning expeditions, congresses, the museum, etc.

XIII. Expeditions

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1936. Biological Data. The Snellius-Expedition in the eastern part of the Netherlands East-Indies 1929-1930, vol. 6, pp. i-viii, 1-29, 1 chart.
1943. Voorloopig verslag over het verzamelen van dieren gedurende de expeditie van het Koninklijk Nederlandsch Aardrijkskundig Genootschap naar Nieuw-Guinee in 1939. Tijdschr. Nederl. Aardrijksk. Gen., vol. 60, pp. 504-522, 1 pl.

XIV. Congresses and visits to institutions

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XV. Museum

1938. Verslag omtrent het Rijksmuseum van Natuurlijke Historie te Leiden loopende over het tijdvak 1 September 1930 tot 31 December 1935, pp. 1-64.

1938. Verslag omtrent het Rijksmuseum van Natuurlijke Historie te Leiden over de jaren 1936 en 1937, pp. i, ii, 1-42.

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1943. Verslag omtrent het Rijksmuseum van Natuurlijke Historie te Leiden over de jaren 1941 en 1942, pp. 1-24.

1944. Verslag omtrent het Rijksmuseum van Natuurlijke Historie te Leiden over het jaar 1943, pp. 1-24, 2 pls.

1946. Verslag omtrent het Rijksmuseum van Natuurlijke Historie te Leiden over het jaar 1944, pp. i, ii, 1-22.

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1950. Verslag omtrent het Rijksmuseum van Natuurlijke Historie te Leiden over het jaar 1945, pp. 1-15.

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1956. Verslag omtrent het Rijksmuseum van Natuurlijke Historie te Leiden over de jaren 1950 tot en met 1954, pp. 1-35.

XVI. Study in Biology at the University

1953. De studie in de biologie. Vakblad Biologen, vol. 33 no. 3, pp. 41-47.

XVII. Biographical Notes

1933. In memoriam Prof. Dr. E. D. van Oort. Leidsch Universiteitsblad, vol. 3 no. 2, pp. 1, 2.

1934. In memoriam E. D. van Oort 1876-1933. Almanak van het Leidsche Studentencorps 1934.

1950. Alida Margaretha Buitendijk. 1 April 1903-12 September 1950. Entomol. Ber., vol. 13 no. 306, pp. 177, 178.

1950. Alida Margaretha Buitendijk. 1 April 1903-12 September 1950. Vakblad Biologen, vol. 30 no. 10, p. 174.

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D. Biographic notes on H. Boschma

1926. C. J. van der Klaauw. Het hooger onderwijs in de zoölogie en zijne hulpmiddelen te Leiden. Een historische schets naar aanleiding van het 50-jarig bestaan van het tegenwoordige Zoölogisch Laboratorium, pp. i-iv, 1-132 (Boschma mentioned on pp. 33, 36, 125, 126 and in notes 665, 700, and 710). Sijthoff, Leiden.
1928. Ambtsaanvaardingen. Jaarb. Rijksuniversiteit Leiden, 1928, p. 122.
1931. Ambtsaanvaardingen. Jaarb. Rijksuniversiteit Leiden, 1931, pp. 109, 110.

INTERNATIONAL COMMISSION ON ZOOLOGICAL NOMENCLATURE

On the occasion of Commissioner H. Boschma's 70th birthday, the International Commission on Zoological Nomenclature takes great pleasure in extending to him its warmest congratulations. At the same time the Commission wishes to express its deep gratitude to Professor Boschma for his long years of service to the Commission in the interests of zoological nomenclature.

Professor Boschma was first elected to the Commission on 1 January, 1947, and has been a member since that time. He attended the meetings of the Commission during the XIIIth, XIVth, and XVth International Congresses of Zoology held respectively in Paris (1948), Copenhagen (1953) and London (1958). The Commission expresses its regrets that due to reasons of health he was unable to attend the XVIth Congress held in Washington, D.C., in 1963.

Professor Boschma's thorough knowledge of nomenclature, his ready appraisal of the consequences of some suggested measures, and his common sense have been of great service to the Commission especially in the difficult years preceding the publication of the new Code. His sense of humour often enlivened what would otherwise have been rather dull discussions, and in many cases under dispute he was able to suggest a solution acceptable to all participants.

The Commission highly appreciates Dr. Boschma's efforts in bringing to Dutch zoologists a better understanding of zoological nomenclature by encouraging his students at Leiden University to become interested in this field. Important work was done by Dr. Boschma during his office as secretary of the Nomenclature Section of the Nederlandsche Entomologische Vereeniging. He was always ready to give his sound advice in nomenclatural problems to his colleagues and pupils.

The Commission expresses the hope that for many years to come it will be able to profit from Dr. Boschma's experience.

J. Chester Bradley
President

W. E. China
Acting Secretary